The added strength of combining clinical screening tests and functional motion analysis: a case study

Jeroen Aeles[1], Styn Vereecken[2], Benedicte Vanwanseele[1]

[1]**KU Leuven** Department of Kinesiology, Human Movement Biomechanics Research Group
[2]**KU Leuven** Department of Rehabilitation Sciences

Introduction & Objectives: Fatigue has a large effect on running economy and running efficiency in various ways [1-2]. Reducing these effects will have a beneficial effect on performance, yet the process of reducing these effects can be complicated due to the large variation in which these effects take form in individual athletes. Here we present a case study of a 24 year old female 800m runner for whom we compare results from a clinical sport specific functional screening (SSFS) with results from a 3D running analysis (3D RA) pre and post fatigue.

Methods:

SSFS: A wide range of tests (Spartanova), including strength, stability and flexibility, were taken to assess risk factors for injury.

3D RA: The subject performed a pre- and post-test in a movement laboratory. In between both tests, a fatigue-training was done. Ten infrared cameras (150Hz) and a split-belt treadmill (ForceLink) with built-in force plates (1000 Hz) were used to collect 3D marker coordinates and ground reaction forces (Nexus, Vicon). A 14 segment, 26 degrees of freedom with 92 muscle-tendon actuators model [3-4] was used (OpenSim 3.2). The model was scaled to fit the subject's individual anthropometry. An inverse kinematics procedure was conducted using a Kalman smoothing algorithm [5] to obtain joint angles for each time frame.

Results:

SSFS: Lower limb strength tests showed a large inequality between left and right leg maximal hamstrings strength and calf endurance, both times favouring the left leg. Furthermore, core stability tests showed a weak rotatory and sagittal core control. Leg stability also showed risk factors for the right leg.

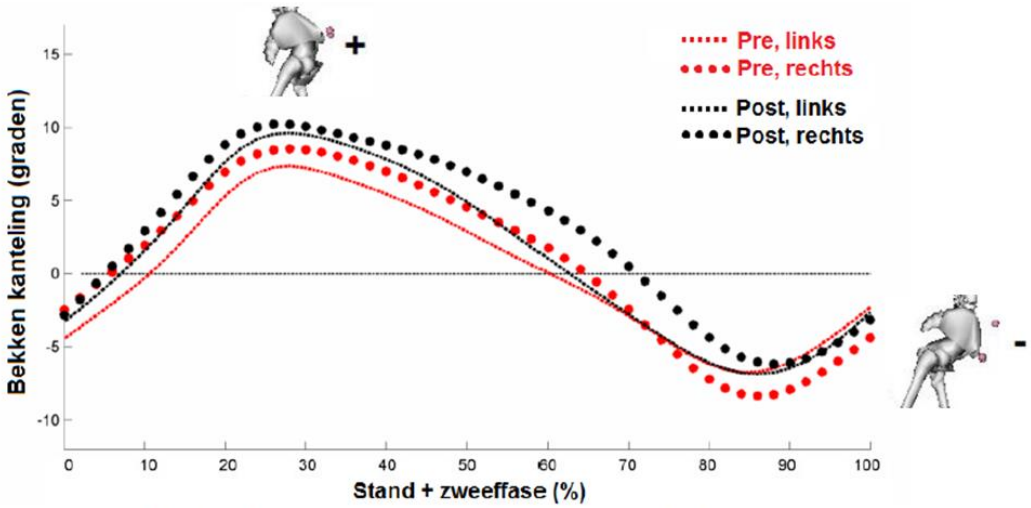
3D RA: There was an increase in pelvic tilt (sagittal plane rotation) in the post-test, mainly at peak values (20-40 % normalised time). When pelvic tilt was calculated for both legs separately a different pattern was found for left versus right leg curves especially during flight phase (70-90 % of normalised time). In the same manner, a different effect of fatigue on pelvic list (frontal plane rotation) was found. Similarly, different effects of fatigue were found in right versus left leg curves in hip flexion and extension.

Conclusion:

Comparison of both tests showed a good overall agreement, mainly in left versus right leg differences. Based on the combined results of both tests, an appropriate programme for the athlete can be provided. Here we show the added strength of combining both clinically relevant screening tests and functional 3D motion analyses to use in injury prevention and performance enhancement.

References

1 Derrick et al., 2001
2 Dierks et al., 2010
3 Hamner et al., 2010
4 Delp et al., 2007
5 De Groote et al., 2008



Figuur 4: bekkenkanteling (voor-en achterwaarts) voor linker- en rechterbeen, pre vs post.